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FAO Plant Protection Bulletin

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World Reporting Service on Plant Diseases and Pests

Entomology Problems in Bolivia [1]

J. Alex Munro

Servicio Agricola Interamericano, La Paz, Bolivia

The entomological work under the United States Point IV Program in Bolivia provides for two main projects, emergency insect control and a reference collection of insects. Special assistance is given in the insect control phase by Raúl Hinojosa, Walter Rodríguez, and Nestor Suárez. The reference collection of insects is located in the experiment station of the Servicio Agricola Interamericano (SAI) at Cochabamba, and is being cared for by Elba de Alandia. The Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, is giving valuable cooperation in the identification of material referred for determination [2]. Manufacturers of insecticides have sent samples of their newer products for testing, and various agencies including the press, radio, missions, and schools have aided the SAI extension service in bringing information on pest control to the attention of the farmers. The more important chlorinated hydrocarbon insecticides are now becoming commercially available on local markets. It is the purpose of this article to review some of the more important insect problems of potatoes, sugar cane, cotton, fruits and miscellaneous crops.

[1] A contribution from the Servicio Agricola Interamericano, a technical agricultural service organization for Bolivia, operated jointly by the Government of Bolivia, the Foreign Agricultural Service, U. S. Department of Agriculture, and the Institute of Inter-American Affairs. U.S. participation in this work was carried out as part of the Point IV Program in Bolivia, administered by the Foreign Operations Administration, U.S. Department of State.

[2] The following specialists have made identifications: R. H. Foote, L. M. Russell, E. W. Baker, D. A. Young, M. R. Smith, C. F. W. Muesebeck, R. H. Arnett, E. A. Chapin, R. E. Warner, C. W. Sabrosky, W. W. Wirth, A. Stone, R. I. Sailer, L. M. Walkley, W. H. Anderson, Kellie O'Neill, H. F. Schwarz, Harold Morrison, K. V. Krombien, H. W. Capps, W. D. Field, A. B. Gurney, F. C. Bishopp, B. D. Burks, J. F. G. Clarke, J. G. Franclemont, T. E. Snyder and R. E. Blackwelder. Helpful references and suggestions were received from Edson J. Hambleton.

Potato Insects

Potatoes, a most important food crop in this part of their ancestral home, are grown mostly in the high mountain valleys and the western high plains (altiplano) which range up to about 14,000 feet above sea-level. The potatoes are subject to a wide assortment of pests, including small white grubs, popularly referred to as "gusano blanco" and scientifically as *Premnotrypes* spp. According to Johannes E. Wille of Peru there are several closely related species in this group which attack potatoes. The predominant form in the Lake Titicaca vicinity in the Bolivian altiplano is *P. latithorax* (Pierce). These grubs may vary in number from one to 20 or more in a tuber. Upon devouring the contents of a tuber (Figure 1) they migrate and invade others nearby.

Other tuber pests include "ticona", a cutworm type of larva which cuts the stalks as well as gouges the developing tubers. The most troublesome species appears to be *Copitarsia consueta* (Wlk.). The potato tuberworm, *Gnorimoschema operculella* (Zeller), is also a destructive pest of potatoes;

Figure 1. *Potato tubers showing severe infestation by gusano blanco or white grubs* (Premnotrypes spp.).

its larvae damage the foliage as well as the the tubers by mining and boring. The seed corn maggot, *Hylemya cilicrura* (Rond.), and various other unidentified wireworms and larvae contribute to tuber damage in this area. It is estimated that they cause an annual loss of about 40 percent of the potatoes. Excellent control of the grubs, wireworms, and cutworms are being obtained by the application of aldrin 2½ percent, or chlordane 5 percent in powder or dust form into the crown of the plants, just before the first hilling, when the plants are a few inches high, at the rate of 100 pounds of the mixture per hectare. This row treatment should be repeated later on, about mid–season, in case of heavy infestations. Lindane is now being tested for the purpose, and it would appear that at 1 to 2 percent strength gives satisfactory results.

The main pests of the potato foliage include the thrips, *Frankliniella tuberosi* Mlt., which becomes abundant towards midsummer, causing a brown or rusted appearance of the foliage; the fleabeetle, *Epitrix* spp.; the leafhopper, *Empoasca* spp.; the blister beetles, *Epicauta* spp.; and to a limited extent the potato aphids. *Rhagoletis psalida* Hendel commonly occurs in the potato fruits.

DDT either alone or in spray combination with Dithane, or aldrin alone or in spray combination with Dithane or Bordeaux are being used to protect potatoes against the main foliage pests. The fungicides are being used in the Cochabamba valley where late blight, *Phytophthora infestans*, occurs. As yet only a small degree of biological control by parasites has been noted from natural sources. A small wasp–like parasite, *Ambluteles* spp., was observed to destroy 16 percent of the cutworms (*Copitarsia* spp.) in their pupal stage during the season of 1952, but was scarce in 1953. Another parasite, *Meteorus chilensis* Porter, recorded as an enemy of cutworms, was commonly reared from infested tubers in 1952.

Sugar Cane Insects

Sugar cane is subject to particularly severe damage at times from borers. In the 1952 growing season a survey conducted by SAI over the sugar cane area in the Santa Cruz vicinity showed an average of 30 percent of the canes infested with the destructive borer, *Metamasius anceps* (Gyll). The loss to the growers, due to poorer quality juice and reduced yield, was considered to be in fairly direct proportion to the percent of canes infested. A similar survey conducted in June 1953 showed the infestation to have dropped to an average of 10 percent of the canes. Growers who had observed the changes in this borer population for many years claimed that the pest was most abundant and damaging in abnormally wet seasons. Preliminary observations would tend to confirm this.

Through the cooperation of R.H. Van Zwaluwenberg, Senior Entomologist, Experiment Station of the Hawaiian Sugar Planters Association and the U.S. Depart-

ment of Agriculture, a supply of the parasite, *Microceromasia sphenophora* Vill., a natural enemy of the Hawaiian species of sugar cane weevil, was obtained from Hawaii and released in a *Metamasius* borer infested field near Santa Cruz in April 1953 in order to determine whether it can establish itself and aid in the borer control.

Other borers of sugar cane include *Diatraea rufescens* Box, *D. saccharalis* (Fab.) and *D. dyari* Box. Harold E. Box, Entomologist, Port of Spain, Trinidad, in commenting on material referred to him from Bolivia reported the presence of *Paratheresia claripalpis* (Wulp.) which is known to be a parasite of *D. rufescens*. Included in the material were three species of Cercopids collected on sugar cane, one of which was described as a species new to science. Other injurious insects of sugar cane are the spittle bug, *Tomaspis spectabile* Dist., and the mealybug, *Trionymus sacchari* (Ckll.) which has been made the type of Ferris' new genus *Saccharicoccus*. Damage from spittle bug was greatest in sugar cane grown near fields of elephant grass (*Pennisetum purpureum*), as this grass was particularly susceptible to this pest.

Burning of borer infested canes, along with other field trash, following harvest was done by growers in an effort to control these insects, especially the *Metamasius* borers. Examination of the scorched canes showed the borers to have been killed, but those in the stubble escaped because of the protection from the soil. There is no extensive use of insecticide in control of any of the sugar cane insects in this area.

Cotton Insects

Although cotton is not as yet grown extensively in Bolivia, the total being about 600 hectares in the Santa Cruz area, yet some of the more destructive pests have already become established. These include the pink bollworm, *Pectinophora gossypiella* (Saund.), recorded from Bolivia in 1951, the cotton leafworm, *Alabama argillacea* (Hbn.), the cotton aphid, *Aphis gossypii* Glov. the cotton stainers, *Dysdercus* spp., thrips and the spider mite. A slight amount of terminal injury to the stems has been noted and is believed to be due to the Curculionids, *Chalcodermus* spp., which were reported by A. A. Ogloblin to girdle the tips of cotton and various other plants in Brazil and Argentina. This type of injury appears on both cotton and kenaf (*Hibiscus cannabinus*) at the SAI experiment station at General Saavedra near Santa Cruz. It is reported that this pest is being checked satisfactorily by timely applications of a DDT spray.

Damage in the larger cotton fields in the Santa Cruz area from leafworms, aphids, and to a lesser extent from the other pests mentioned, approximated 65 percent in the 1952 season. This loss could have been largely prevented had there been an adequate supply of the required insecticides and equipment for their application. The smaller, out of season plantings suffered heaviest damage from pink bollworm, occasionally up to 70 percent of the bolls being damaged. An effort is being made to bring into force regulations requiring the growers to observe a uniform harvesting period, to make possible the necessary clean-up and cultural practices that are so essential in pink bollworm control. A recent visit to two of the larger cotton farms in this area revealed the effective use now being made of modern spray equipment and insecticides and the insects being kept well under control. One of the growers was using a new 10-row sprayer, which was being rented from the reimbursible facilities project of SAI until arrangements can be made for its purchase. The other grower was using a new sprayer which he had purchased at the beginning of the current season.

Natural control agencies which have been observed to be quite active against aphids include the lady beetles, *Cycloneda sanguinea* L., *Eriopis 17-punctata* Latr., and *Hyperaspis festiva* Muls. The syrphid flies were identified as *Bacca clavata* (F.), *Allograpta exotica* (Wied.), and *A. obliqua* (Say).

Insects of Citrus and Other Fruits

Most of the citrus and other fruits are grown in the lower mountain valleys and the lowlands. The most widespread of the pests of groves thus far noted are scale insects. They include the purple scale, *Lepidosaphes beckii* (Newm.), the long scale, *L. gloverii* Pack, the rufous scale, *Selanaspidus articulatus*

(Morg.), the green coffee scale, *Coccus viridis* (Green), and the cottony cushion scale, *Icerya purchasi* Mask. Fortunately the cottony cushion scale is being held in check very satisfactorily by the Australian lady beetle, *Rodolia cardinalis* Muls., in localities where it has been introduced. The white fly, *Aleurothrixus floccosus* (Mask) is a common pest. Spraying with oil emulsion is being practised in some places to check the white flies and scale insects.

Thrips, *Heliothrips haemorrhoidalis* (Bouché), has been most commonly noted on citrus in the mountain valley locations but is apparently more widespread, as evidenced by their characteristic feeding scars on the fruits in most of the town and city markets. DDT is effective in the control of this pest.

Aphids are prevalent but seldom very destructive to citrus. They include the green citrus aphid, *Aphis spiraecola* Patch, the black citrus aphid, *Toxoptera aurantii* (Fonsc.), and the cotton aphid, *Aphis gossypii* Glover. Lady beetles, larvae of lace–winged and syrphid flies, and small parasitic wasps aid greatly in holding these aphids in check.

Fruit flies cause severe damage at times to citrus and other fruits in various parts of Bolivia. According to Raúl Pérez Alcalá, Entomologist of the Bolivian Ministry of Agriculture, the South American fruit fly *Anastrepha fraterculus* (Wied.) is the most troublesome in the Cochabamba and Tarija vicinities, and the Mediterranean fruit fly, *Ceratitis capitata* (Wied.), is believed to contribute to the damage particularly at Cochabamba. He adds that so far as known the fruit flies are troublesome in all fruit growing parts of Bolivia. In an effort to establish natural control, an initial shipment of *Opiine* parasites of the fruit flies was obtained by SAI through the cooperation of the U.S. Department of Agriculture from Hawaii in September 1953, and released in one of the more heavily infested fruit growing areas of the yungas. Observations will be made to determine if they are able to establish themselves successfully.

Considerable damage was done to pears by both the clover mite, *Bryobia praetiosa* Koch, and the pear leaf blister mite, *Eriophyes pyri* (Pag.). Upwards of 80 percent of the fruits were deformed and many of the leaves damaged in 1952 by these pests, but the injury was less in 1953. At one of the lower elevations of La Paz (Obrajes) the greedy scale, *Aspidiotus camelliae* Sign., was damaging prune trees; and the scale, *Diaspis* sp. nr. *chilensis*, was causing damage to peach trees both here and at Cochabamba. Aphids are also quite abundant and damaging on peach trees at times.

Treehoppers, *Aconophora* spp., were causing damage to apple, peach and plum trees, and the leafhoppers, *Aetalion* spp., were doing injury to apple trees in June 1953.

Damage of pineapple plants estimated at 25 percent was caused by the larvae of the rhinoceros beetle, *Strategus jugurtha* Burm., in commercial plantings located in the vicinity of dense woods. There was never more than one larva to a plant. It usually fed and gouged into the center of the main stalk with the result that the plant was destroyed or put out side shoots below the point of injury. Unidentified small grubs fed within the fruits in several plantings near Montero, north of Santa Cruz, and resulted in spoiling about 40 percent of the fruits for the market. No satisfactory control of these pineapple pests has been demonstrated as yet in this area.

Insects of Other Crops

Mites identified as *Tetranychus desertorum* Banks caused notable injury to alfalfa in the Cochabamba valley in 1953. The mites were so abundant as to appear as reddish patches among their silken webbing on the plants. Dusting with sulphur was recommended, as no other acaricides were available. Leafhoppers, *Cuerna centrolineata* Melichar, were also damaging alfalfa. Both the fall armyworm, *Laphygma frugiperda* (S. & A.) and the larvae of a Noctuid, probably *Mocis latipes* Guenee, are injurious to rice, maize and other crops in the lowlands.

Kenaf, a fiber plant introduced only recently into the eastern Santa Cruz region of Bolivia, is receiving considerable interest from farmers who use it for making ropes and sacks. As mentioned above, it already suffers from the attack of the Curculionids, *Chalcodermus* spp., which girdle and sever the stems of the growing plants (Figure 2).

Leaf cutting ants, *Atta* spp., are widespread and probably cause more damage

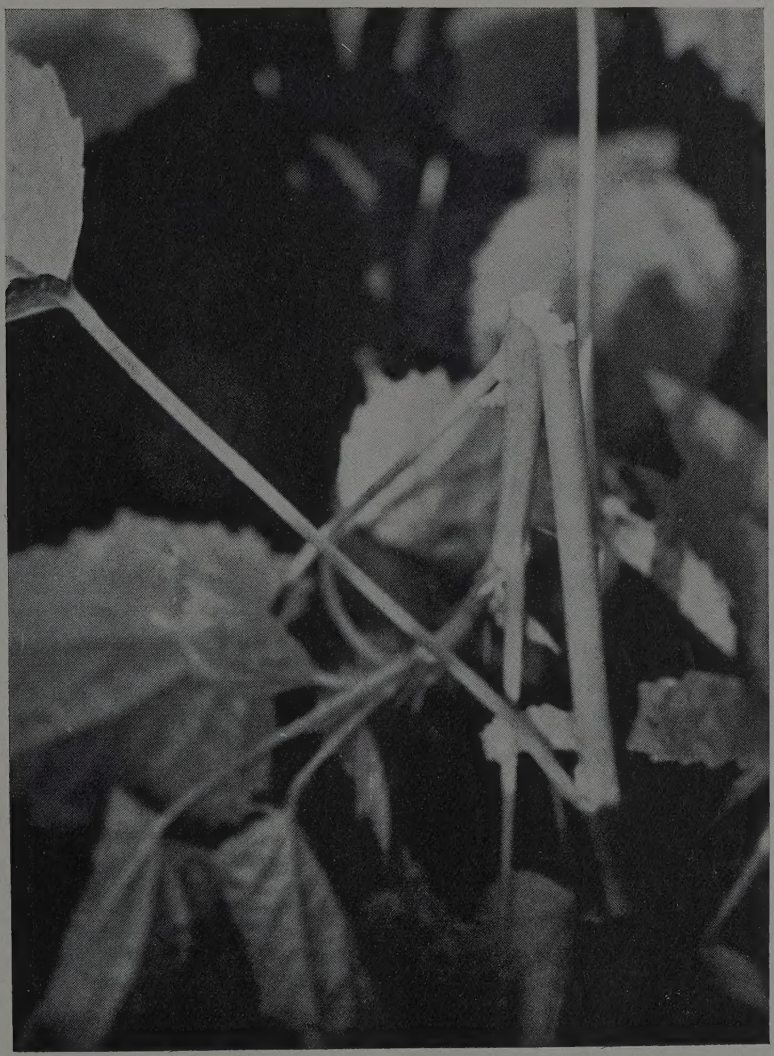

Figure 2. *Kenaf plant showing severed stem caused by Chalcodermus spp.*

to vegetation than any other closely related group in Bolivia. Alcalá, who has studied their taxonomic position, geographic distribution and intensity of infestation, points out that *A. laevigata ligeri* Santschi predominates in the Santa Cruz region, *A. sexdens rubropilosa* Forel in the central zone of the country (Monteagudo), and *A. sexdens fuscata* Santschi in the northwest (Mapiri), and that these species are distributed over an area corresponding to two-thirds of Bolivia. These ants cause severe defoliation to citrus and various other agricultural crops. The newer methods of applying chlordane, aldrin or dieldrin into the entrance -exit openings to their underground colonies is giving excellent results in control, and is being rapidly adopted by the growers.

Overwintering of Cultivated Plants under Snow

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In countries where overwintering plants are covered by snow for several months every year, research workers must attempt to answer several complicated questions. On the one hand the snow cover effectively protects the plants from frost damage; on the other hand, it permits parasitic fungi thriving at low temperatures to damage plants during the winter. Recently the Department of Plant Pathology, Agricultural Research Center of Finland, has been studying this problem. The Swedish Plant Protection Institute has also carried out investigations in this connection for several years, under the supervision of H. Ekstrand [1, 2]. The present paper outlines the results so far obtained during the investigations carried out in Finland, and discusses the problem in general.

Causes of Poor Winter Survival in Finland

The successful overwintering of plants is in many cases the decisive factor determining yields in Finland, since about 60 percent of the cultivated area is sown with wintering plants, namely, winter rye, winter wheat, ley grasses, clover, and recently winter turnip rape. Their reactions to cold injuries and to various parasitic fungi are summarized in Table 1.

In south and southwest Finland the ground is usually covered by snow from December to the end of March; in the central and east central parts from November until towards the end of April; in the northern parts of the country snow falls as early as October and remains until May. Owing to the maritime climate, the snow cover is often fairly thin in the southern, southwestern, and western parts of the country, where in some years fields may be quite uncovered during most of the winter. Investigations have shown that in these parts of the country cold injury to overwintering plants may be heavy, while damage by parasitic fungi is rare owing to deep freezing of the soil. On the other hand, in the central, eastern, and northern parts of the country where the ground is usually covered by a deep layer of snow, overwintering plants do not generally suffer any severe losses due to the cold. The parasitic fungi, however, cause greatest damage in these regions, especially in central, east and north Finland.

WINTER CEREALS. The investigations carried out to date show that the winter rye varieties grown in Finland are not severely injured by cold. During winter and in districts with little snow, winter rye has generally survived well. Winter wheat, on the other hand, is susceptible to cold and is easily destroyed if there is no snow cover to protect it. This applies to all the winter wheat varieties generally grown in Finland.

The most important fungi damaging graminaceous plants during overwintering, the so–called parasitic winter fungi, are: *Fusarium nivale* (Fr.) Ces., the cause of snow mould; Typhula blight (speckled snow mould) caused by *Typhula itoana* Imai and *Typhula* cfr. *borealis* Ekstrand; and *Sclerotinia borealis* Bubák & Vleugel [3]. Of

[1] EKSTRAND, H. Some phytopathological views of the overwintering of winter cereals and forage grasses with special regard to the experimental work in agriculture. *Statens Vätskyddsanst. Meddel.* 49: 1–48. 1947.

[2] EKSTRAND, H. Winter cereals and the problem of winter hardiness with special regard to the resistance to certain fungi. *Statens Växtskyddsanst. Meddel.* 50 : 1–28. 1947.

[3] JAMALAINEN, E. A. Overwintering of Gramineae plants and parasitic fungi. I. *Sclerotinia borealis* Bubák & Vleugel. *Suom. Maataloust. Seur. Aikakausk.* 21 : 125–142. 1949.

Table 1. *Reactions of various plants to cold injury and to parasitic winter fungi in Finland* [1].

Crop	Cold Injury	*Fusarium nivale*	*Typhula* spp.	*Sclerotinia borealis*	*Sclerotinia trifolium*	*Sclerotinia sclerotiorum*
Winter rye	+ +	— —	+			
Winter wheat	— —	+	— —	— — [2]		
Phleum pratense	+ +	+ +	+	+		
Dactylis glomerata	— —	—	—	—		
Alopecurus pratensis	+ +	+ +	+ +	+ +		
Festuca pratensis	+ +	+ +	+ +	+ +		
Lolium multiflorum	— —	— —	— —	— —		
Lolium perenne [3]	— —	— —	— —	— —		
Trifolium pratense	— —	?	?		— —	
Winter turnip rape	+		— —			— —

[1] Reactions are indicated by the following symbols: + + = resistant; + = fairly resistant; — = fairly susceptible; — — = susceptible.

[2] Winter wheat is not grown in the areas where *Sclerotinia borealis* occurs, but appears to be susceptible in experiments.

[3] The strain Valinge is fairly resistant to parasitic winter fungi.

the winter cereals, winter rye is susceptible to snow mould. This has been established by experiments carried out in different parts of Finland during several years which proved that seed dressing gave an average yield increase of 19 percent in winter rye. Detailed investigations in different parts of the country confirm this result. On the other hand, seed dressing experiments indicate that at least the varieties of winter wheat commonly grown in Finland, such as Olympia and Varma, are fairly resistant to snow mould.

Winter rye, or at least the varieties generally grown in Finland, seems to be fairly resistant to *Typhula* fungi. Winter wheat again is susceptible to these fungi and in some cases was totally destroyed by *Typhula* during overwintering. The poor survival of winter wheat on sandy soil is at least partly due to these fungi.

Sclerotinia borealis occurs only in the central and northern parts of Finland, but is found also in north Sweden and Norway. *Sclerotinia graminearum* Elenev, occuring in graminaceous plants in the Soviet Union, is the same species as *S. borealis* or similar to it. According to the investigations carried out in Finland, in some years, particularly in the winters of 1945–46 and 1952–53, *S. borealis* caused severe losses in winter rye and other susceptible graminaceous plants.

The varieties of winter rye which are most resistant to parasitic fungi in Finland are the Finnish bred Ensi, Toivo, the local strain Greus, and Vjatka introduced from northern Russia, all of which can be grown in the central, eastern, and northern parts of the country. Slightly less resistant are the Finnish varieties Pekka, Oiva and Onni, which are best adapted to the southern and western parts of Finland.

Winter barley is not grown in Finland. Judging from observations made in test cultivations of winter barley, susceptibility to *Fusarium nivale* seems to be the chief factor restricting the cultivation of this plant in Finland.

LEY GRASSES. The ley grasses grown in Finland, especially timothy (*Phleum pratense*), are resistant to damage by cold. Timothy is also fairly resistant to snow mould, *Typhula* fungi and *Sclerotinia borealis*, but this is not true of all strains. It was found that some imported strains are very suscep-

tible to *S. borealis*. The Swedish variety of timothy, Bothnia, has been found to be almost completely resistant to parasitic winter diseases, both in Sweden and in Finland. The reliable results obtained in growing timothy and its popularity in Finland can be attributed to its resistance to both parasitic fungi and cold. Cocksfoot (*Dactylis glomerata*), a valuable ley grass in Finland, has proved to be rather susceptible to snow mould, *Typhula* fungi, and *S. borealis*. Meadow fescue (*Festuca pratensis*) is fairly resistant to parasitic winter fungi. According to the available information, *Poa serotina* is susceptible to *S. borealis*. Ryegrass (*Lolium*) is not grown extensively in Finland because of its susceptibility to parasitic winter fungi. The strains of *Lolium multiflorum* investigated were mostly destroyed by *Fusarium nivale*. Most strains of *Lolium perenne* are also destroyed by snow mould and other parasitic winter fungi but the strain Valinge is resistant and is therefore well suited to Finnish conditions. Ryegrass is susceptible to damage by cold if not well covered by snow.

As already mentioned, strains of grasses imported from abroad were generally found to be susceptible to parasitic winter fungi.

CLOVER. Red clover (*Trifolium pratense*) is the commonest clover in Finland, but its cultivation is made difficult and uncertain by its capricious overwintering. *Sclerotinia trifoliorum* Erikss., which occurs everywhere in Finland, even north of the Arctic Circle, is the most important of the parasitic fungi. It may cause considerable losses and in some years favorable to its development it may completely destroy the wintering clover. When Sclerotinia disease is very prevalent no strains escape damage, though individual strains differ in their resistance. Tammisto red clover and some other Finnish strains are more resistant to damage caused by this disease than the imported strains investigated. Cold is another important factor causing the disappearance of clover from leys. Where there is very little or no snow, all strains of red clover are completely destroyed. Even *Typhula* sp. has been found to occur in clover; but its significance in affecting overwintering has not yet been ascertained in Finland.

CRUCIFEROUS OIL PLANTS. Cruciferous oil plants have been cultivated in Finland for only a few years, winter turnip rape (*Brassica campestris* var. *oleifera* f. *biennis*) being the most important. According to observations, all varieties of winter turnip rape, with the exception of Lembke, are resistant or fairly resistant to winter cold in Finland. The parasitic fungi, *Typhula* spp. and *Sclerotinia sclerotiorum*, are significant factors affecting the overwintering of this crop. In the central and eastern parts of the country the losses caused by these fungi during the winter have been so great as to make the cultivation of rape very hazardous and for this reason the cultivation of this plant is limited to the southern and western parts of the country.

A Problem for Continuous Research

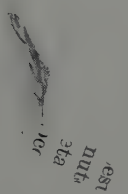
Several questions concerning parasitic winter fungi or overwintering fungi and their biology and distribution remain unanswered. As far as we know, there exists no general account of the occurrence of these fungi in different countries. The pathogenicity of the different species and their physiological races require more detailed investigation. Critical species in this respect are *Typhula* spp. According to the author's observations [4] these fungi may frequently occur in Finland in graminaceous plants immediately after the disappearance of the snow in spring, although the losses are slight. In other cases they may be very destructive, destroying the stand completely. Besides information regarding the distribution of parasitic winter fungi and the losses caused by them, further information concerning their biology, especially their temperature requirements, is also needed. Reactions of different plant species, varieties and strains to various parasitic winter fungi and to cold should be studied more extensively.

In breeding winter-hardy varieties and strains, special attention must be paid to their place of origin. The best material for breeding, with regard to winter hardiness, is usually obtained from the varieties grown locally. The reactions of varieties and strains

[4] JAMALAINEN, E. A. Förekomsten av övervintringssvampar på vallgräsen i Finland. (Occurrence of parasitic winter fungi in grasses in Finland.) *Nord. Jordbruksforsk.* 2-3: 529–534. 1951.

of overwintering plants are not always the same in two countries, even if climatic conditions are similar. For example, certain strains of grasses imported into Finland from Canada have proved susceptible to parasitic winter fungi. In this case the strains of grasses developed in a continental climate do not react to parasitic winter fungi in the same way as the Finnish strains, or probably the physiological races of these fungi in North America are different from those in Finland. The overwintering of new varieties should be tested under the conditions for which they are intended. For instance, the varieties developed by breeding institutes in south Finland in districts with little snow may be susceptible to parasitic winter fungi and therefore they should be tested in districts where these fungi are prevalent.

In Europe, the study of the causes of poor winter survival of plants is important not only in the northern countries, but also in central Europe, where overwintering plants are covered by snow for long periods. The same problem arises in the northern parts of Asia and in Canada and the northern parts of the United States.



Plant Disease Situation in the United States

PAUL R. MILLER

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Nematodes Associated with Avocado Roots in Florida

THE burrowing nematode, *Radopholus similis* (Cobb) Thorne, was recently reported as the cause of the "spreading decline" disease of citrus in Florida [1]. Many growers wish to replace citrus in spreading decline areas with avocado trees but are doubtful whether replanting would be advisable without soil treatment.

Field collections of avocado roots from spreading decline areas were examined for infestation by *Radopholus similis* or other parasitic nematodes. In one grove where diseased citrus trees had been removed and soil had not been treated, avocado trees were planted in the spring of 1950. Samples of roots from these replacement avocado trees showed characteristic dark brown to black lesions, either small localized spots or extensive depressed lesions girdling the root for several inches. These lesions were restricted to the fleshy cortex. The burrowing nematode, *R. similis*, and the meadow nematode, *Pratylenchus pratensis* (de Man) Filipjev, were found in these root lesions.

A mixed planting of mature avocado and citrus trees in a spreading decline area was examined. The roots of both avocado and citrus were infected with *Radopholus similis* only. Typical dark brown to black lesions were present on the avocado roots and rootlet rot was extensive. Feeder roots were scarce below a depth of two feet. These symptoms on avocado trees are comparable to those on citrus trees affected by the spreading decline disease. Like citrus, avocado trees within the infested area showed a decline condition whereas outside the area they were healthy.

In addition to *Radopholus similis* and *Pratylenchus pratensis*, *Aphelenchus avenae* Bastian, *Criconemoides citri* Steiner, *Trichodorus* sp., and various Dorylaimids were also found associated with avocado roots.

It may be concluded that as avocado trees are susceptible to attack by *Radopholus similis*, which causes a decline of the trees, it is not advisable to plant avocado in areas of citrus spreading decline without proper soil treatment.

A Bacterial Parasite of Tamarisk

A bacterium that kills potted tamarisks in the greenhouse has been repeatedly isolated in pure culture from infected tamarisks in Arizona, New Mexico, and Texas. Isolation of the bacterium from dying and dead salt-cedars (*Tamarix pentandra*) in all tamarisk areas observed suggests that the parasite is the cause of the sickness and mortality.

The bacterium seems to be the first bacterial parasite reported on tamarisks. It is remarkably resistant to heat for it was not completely killed in suspension in a liquid medium, in the usual thermal death point tests, at a temperature of 98.5° C. for 10 minutes, although its subsequent growth was retarded. On solid media it develops streptococcus–like colonies but the individual cells are straight rods that may become motile when free. On artificial inoculation into tamarisks, the bacterium kills leaves, twigs, and entire rooted cuttings from which it has been re-isolated in pure culture.

The bacterium appears to attack the parenchyma. It seldom causes even in-

[1] MILLER, P. R. The burrowing nematode and other parasitic nematodes in relation to spreading decline of citrus. *FAO Plant Prot. Bull.* 2 : 36–39. 1953.

conspicuous lesions before the superficial layers of cells of the attacked parts collapse, apparently from excessive loss of water. The affected foliage turns brown and may hang in formless bunches on the host plant.

The known host, *Tamarix pentandra*, is a most obnoxious weed. It was introduced into Arizona some time prior to 1901. Following wet seasons, the plant has spread until it reportedly almost monopolizes a total area of hundreds of square miles along rivers and washes in the three States. The most objectionable characteristic of the salt-cedar is its efficiency as a pump. In dense growths it transpires so vigorously that little water in the form of showers actually reaches the

Figure 1. *Panicles of orchard grass infested with seed nematode. Healthy panicle on left. Natural size.*

subterranean reservoir. Destruction of this weed through the use of chemicals, mechanical removal with bulldozers, etc., is expensive, hence the search for natural enemies of the troublesome plant.

A Seed Nematode Observed in Orchard Grass in Oregon

Three malformed panicles bearing nematode galls in place of seeds were found late in May 1947 in orchard grass (*Dactylis glomerata*) on the Agricultural Expriment Station farm at Granger, Oregon. The affected orchard grass inflorescences were distorted considerably (Figure 1). The disease is caused by a nematode of the genus *Anguina*. One species of this genus, *A. agrostis* (Steinbuch) Filipjev, causes economically serious seed gall diseases in Astoria bentgrass (*Agrostis tenuis*), seaside bentgrass (*A. palustris*), and chewings fescue (*Festuca rubra* var. *commutata*) in Oregon.

Fewer galls were found in the orchard grass heads than might be expected from the effects on the panicles. The galls were short and thick; whereas those on bentgrass and chewings fescue incited by *Anguina agrostis* are long and thin.

The specimens were found in apparently volunteer plants of Akaroa orchard grass, F. C. 22400, adjacent to a rod row of Akaroa in an observational grass nursery. Plants in this and other nearby rows had been harvested in a manner that largely excludes seed shattering, which probably explains the lack of increase of the nematode.

No similar symptoms in orchard grass have been seen in grass nurseries of fields in Washington, Michigan, Kentucky, or in Oregon prior to or since the discovery of these specimens. A special search during the period 1947 to 1953 to find additional specimens in Oregon was made without success.

Outbreaks and New Records

Italy

Plant Protection Service,
Ministry of Agriculture, Rome

The following notes record the noteworthy incidence of some established plant pests and diseases observed during the period from September to December in 1953.

Olive and Other Fruits

The olive fly, *Dacus oleae* Rossi, attack was rather severe during September and October in the southern parts of Tuscany, Liguria, Apulia (Puglia), Campania and Sicily. During the following months the infestation progressed considerably in Tuscany and extended into other regions. In the coastal zone of Tuscany and Liguria, however, damage was light wherever control measures using sweetened poison bait were practised. Good control was also obtained with organic phosphate insecticides. At Foligno and Spoleto of Umbria rather serious infestation by this insect was reported. On the Adriatic coast damage to olive fruits amounted to from 20 to 50 percent. Around the Gulf of Salerno infestations occurred late but were very intensive.

Other pests infesting olive trees during the period referred to included the olive kernel borer, *Prays oleae* Bern = *P. oleellus* F., which attacked the foliage of olive trees in Puglia, and the Cecidomyiid *Clinodiplosis oleisuga* Targ., which sporadically infested and often killed the young olive branches in Perugia.

Olive anthracnose caused by *Gloeosporium olivarum* Almeida was prevalent in the provinces of Brindisi and Lecce, to which area of the Adriatic coast this disease in still restricted, causing extensive losses and much concern to the growers.

The citrus mealybug, *Pseudococcus citri* Risso, was very destructive on many plants in the province of Naples. Extensive attacks occurred especially in citrus orchards in the peninsula of Sorrento and in the communal gardens of Vesuvius.

Apple scab caused by *Venturia inaequalis* (Cke.) Wint. caused losses of apple fruits in Bagnara Calabra in south Calabria.

Vegetables

The cabbage root worm, *Chortophila brassicae* Bouché, caused some damage to flowering broccoli during November and December in the province of Bari.

Young cabbage plants in the vegetable growing areas along the seacoast of the provinces of Bari and Brindisi were damaged by *Lixus* sp.

Forest Trees

Poplars were heavily infested by the aphid *Phloemyzus passerini* Sign. during November and December in the provinces of Rovigo, Verona, and Friuli (Udine) in northeast Italy, and also in a large plantation at Scaldasole in the northern province of Pavia. This aphid usually attacks the trunk and branches of the trees but, whenever soil conditions permit, it also infests the roots. Parathion and other organic phosphate compounds, or BHC, were used successfully to control this insect.

San José scale, *Aspidiotus perniciosus* Comst., caused serious damage to *Populus canadensis* in the province of Cremona during September and October. This plant was hitherto reported to be attacked only occasionally by this insect.

During the same period, chestnuts in Piedmont and Tuscany suffered from increasing attacks of two Tortricids, *Cydia splendana* Hb. and *C. amplana* Hb., and from the chestnut weevil, *Curculio elephas* Gyll. All these insects caused heavy losses of the

nuts, but *C. amplana* occurred less commonly.

Two Pyralids, *Dioryctria mendacella* Stgr. and *D. pineae* Stgr., were found on the cluster pine (*Pinus maritima*) in the coastal area of the province of Livorno.

In the province of Rome, die-back of small branches of cypress was rather common. Experimental results indicate that this disease is caused by *Coryneum* sp. and *Alternaria* sp.

United States

Plant Pest Control Branch,
Agricultural Research Service,
United States Department of Agriculture

Results of Recent Insect Abundance Surveys

Surveys for grasshoppers (Acrididae) in cropland areas show build-ups in several mid-western states with greatest increase in Missouri and Wisconsin. Grasshopper infestations serious enough to warrant large-scale control programs on range land areas in 1954 are expected in 13 western states.

Chinch bug, *Blissus leucopterus* (Say), may be of economic importance in 1954 in parts of several grain-producing states, primarily Arkansas, Missouri, Illinois, and Indiana.

According to hibernation surveys on European corn borer, *Pyrausta nubilalis* (Hbn.), during the fall of 1953, the average number of borers increased 28 percent over 1952 in counties surveyed both years.

Late-winter surveys in semi-arid breeding areas of the beet leafhopper, *Circulifer tenellus* (Baker), reveal that early movement of this vector of the destructive curly-top virus into cultivated areas of the western states is expected to be light.

PLANT QUARANTINE ANNOUNCEMENTS

Federation of Malaya

The Agricultural Pests and Noxious Plants Ordinance of 27 November 1953, published in *Supplement to the Federation of Malaya Government Gazette*, Vol. 6, No. 31, 24 December 1953, consolidates and supersedes all previous legislation on agricultural pests which had been issued by the Federated Malay States, Unfederated Malay States, the Straits Settlements, and the Malayan Union. The Ordinance authorizes the High Commissioner in Council to make rules for carrying out its provisions, including rules for control of, and the conditions governing, the import or export of plants or pests.

In addition to measures providing for the control and eradication of plant pests and noxious plants present in the Federation, the Ordinance prohibits the importation of any noxious plant except by the Director of Agriculture or by a person duly authorized to do so by an Inspecting Officer. *Eichornia crassipes* (water hyacinth) and *Hevea spruceana* have been declared as noxious plants for the purposes of the Ordinance.

The Ordinance also requires the landowner or occupier to report immediately the appearance of any dangerous pest and to carry out instructions given by an Inspecting Officer to effect its destruction.

The Dangerous Pests Order of 31 December 1953, published in *Supplement to the Federation of Malaya Government Gazette*, Vol. 7, No. 1, 7 January 1954, declares the following as dangerous pests for the purposes of the Ordinance of 1953.

Dothidella ulei (South American leaf blight of rubber).
Marasmius perniciosus (witches broom disease of cacao).
Virus diseases of cacao (swollen shoot disease).
Locusta migratoria manilensis (migratory locust).

German Democratic Republic

An Order of 24 September 1953, published in the *Gesetzblatt der Deutschen Demokratischen Republik*, No. 103, 3 October 1953, authorizes the establishment of a plant inspection service under the Ministries of Agriculture and Forestry to enforce domestic and foreign plant quarantines. The service will undertake to examine plants and raw plant products as well as packing materials offered for import or export or in transit, and to issue import permits and certificates with regard to origin and healthy condition. The service will also undertake nursery inspection and keep records on the incidence of pests and diseases within the country.

First Enforcement Regulations under the above-mentioned Order, issued on the same date, establish the following customs offices and control passing points as points of entry for plants and raw plant products to be imported or in transit;

Bad Schandau – for rail and ship transport
Frankfurt/Oder – for rail and road transport
Warnemünde – for rail and ship transport
Gutenfürst, Plauen, Probstzella and Ellrich – for rail transport
Dornholz – for road transport
Wartha, Marienborn, and Horst/Schwanheide – for road and rail transport
Oebisfelde – for rail and ship transport
Cumlosen – for ship transport

For shipments between areas of West Germany, involving transit through the German Democratic Republic, seven places are authorized as points of entry.

A model of the inspection certificate to be issued after examination at the point of entry is annexed to the Regulations, indicating whether the import or transit consignments are to be admitted or rejected, or the conditions to be fulfilled.

Mauritius

A summary of the regulations relating to the restrictions on the importation into Mauritius and the dependencies of plants, animals and animal products was published in December 1953 by the Mauritius Department of Agriculture as Bulletin No. 88, for the purpose of bettering understanding of the restrictions imposed and their purposes. In the foreword, an interesting account is given of the history on the invasion into Mauritius of dangerous pests and diseases. It is considered most fortunate that the sugar cane crop, upon which the welfare of the island is completely dependent, is still free from many serious diseases; even a disease as widespread as sugar cane mosaic is unknown. The protection of this crop is therefore one of the main aims in enforcing plant quarantine measures.

United Kingdom

Import of Raw Cherries Order 1954, which will come into force 1 May, prohibits the importation in any year of raw cherries grown in Southern

Italy, Portugal or Spain during the period from 1 June to 30 September, and those grown in Austria, Bulgaria, Southern France, Hungary, Northern Italy or Yugoslavia during the period from 16 June to 30 September. Other imports of raw cherries from a European country must be accompanied by a certificate issued by an officer of the phytopathological service of the country of origin in the form set out in the Order, indicating the origin of the consignment and its freedom from cherry fruit fly (*Rhagoletis cerasi*). An authorized officer may examine and take samples of consignments of imported raw cherries and provision is made for the disposal of raw cherries landed in contravention of the Order. Licences may be issued by the Ministry of Agriculture and Fisheries in relief of the requirements.

NEWS AND NOTES

FAO Meeting on Wheat and Barley Breeding in the Near East

The Third FAO Meeting on Wheat and Barley Breeding in the Near East will be held in Damascus, Syria, 26 April to 2 May 1954.

As a result of previous meetings, a series of co-operative uniform wheat and barley nurseries have been established for observation on resistance to diseases in thirty locations in the following participating countries: Cyprus, Egypt, Iran, Iraq, Jordan, Lebanon, Pakistan, Syria and Turkey. During the forthcoming meeting, a summary report will be presented on the results of these cooperative nurseries obtained in 1952/53. Representatives of participating countries will report on progress in wheat and barley breeding in 1953/54, including observations available from the cooperative nurseries during the current season and activities of National Committees on Wheat and Barley Breeding. Plans for further cooperative investigations in the next season will also be discussed.

European Plant Protection Organisation

During 1954 the European Plant Protection Organisation has so far convened two international technical conferences, one on the Mediterranean fruit fly (*Ceratitis capitata*) held in Algiers, 26–29 January, and the other on the fall webworm (*Hyphantria cunea*), held in Vienna, 22–23 February. The reports of both of them will be published shortly.

One result expected of the Mediterranean fruit fly conference is the setting in motion, in the near future, of a coordinated scheme for the investigation of modern methods of controlling this serious pest.

Representatives of nine countries, and of FAO, attended the conference on the fall webworm. It is worth recording that the Hungarian and Czechoslovakian governments sent delegates to this meeting, thus renewing the useful contacts previously established between those countries and the International Colorado Beetle Committee, the predecessor of the European Plant Protection Organisation.

In general, the fall webworm situation in 1953 was much more favorable than might have been anticipated in 1951, when the very severe attacks in Austria and Yugoslavia, particularly the latter, were brought to the notice of the European Plant Protection Organisation, and practical measures of help for the two infested countries were initiated with assistance from four other member governments, to operate in 1952. In all countries concerned the first generation in 1953 was of a very low intensity. This is attributed both to climatic conditions and to the results of control in 1952. The second generation, however, was unexpectedly numerous. Nevertheless the area of infestation was not extended; in fact it even receded, in some places as far as the 1951 limits. Another proof of the mildness of the 1953 attacks is that damage was nearly always limited to mulberry trees (*Morus* sp.) and maple trees (*Acer negundo*), whereas infestation of fruit trees was exceptional. The immediate threat of spread of the pest seems therefore to have been averted, but optimism should not be exaggerated. Insect populations may fluctuate irregularly, and in the case of the fall webworm, whose second generation last year met with favorable weather conditions, a new increase may occur even in the present year.

The annual meeting of the Council of the European Plant Protection Organisation will be held in Paris on 28–29 April 1954, preceded by a meeting of the Executive Committee on 27 April.

Roma - Tip. del Senato del dott. Giovanni Bardi

SOME FAO PUBLICATIONS

***Soil Surveys for Land Development*, 1953, xii+110 pp. $ 1.00, 5s.**

Sufficient of the techniques of soil classification and mapping are outlined so that the mode of operation, the type of equipment involved and the cost of the work can be accurately assessed.
Maps in color. Good bibliography.

***Legumes in Agriculture*, 1953, xiii+367 pp. $ 3.00, 15s.**

This volume brings together a unique selection of information about legumes. It called for the collaboration of specialists in all member countries of FAO; 111 are cited in the general acknowledgements and many more are mentioned in the text itself.

***Agricultural Development and Rural Reform in Denmark*, 1953, vii+320 pp. $ 3.00, 15s.**

FAO is now giving considerable attention to land tenure problems. This monograph covers not only the subject of land tenure, but also several aspects of agricultural development in Denmark closely associated with this subject, so that it can be considered as a significant contribution to the work of FAO in this field.

***Improving the World's Grasslands*, 1951, xiii+147 pp., 107 illustrations, 12 tables. $ 2.00, 10s.**

"It is an important contribution to the subject; the general reader will find it of interest, while the specialist will find it invaluable." - Review in *World Crops*.
(Published for FAO by Leonard Hill Ltd., 9 Eden Street, London N.W. 1., England).

***Weed Control by Growth-Regulating Substances*, 1951, iii+36 pp., 5 illustrations, 2 tables. Third English printing. $ 0.50, 2s. 6d.**

All three editions of this short book have sold rapidly and the Spanish and French editions have been serialized in the agricultural press.

***Efficient Use of Fertilizers*, 1949, x+182 pp., 50 illustrations, tables, maps, charts. Second English printing, 1952. $ 2.00, 10s.**

This handbook on fertilizers and their use in crop production is one of FAO's best-sellers. The Spanish edition, which has been serialized six times in Latin America and Spain, is now in its second printing. The English edition is obtainable from Leonard Hill Ltd., 9 Eden Street, London, N.W. 1., England.

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